HYDRAULIC CONDUCTIVITY STUDY IN ENGINEERED SOIL MEDIA FOR STORMWATER RUNOFF TREATMENT IN BIORETENTION FACILITY

HUSNA BINTI TAKAIJUDIN

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by

HUSNA BINTI TAKAIJUDIN

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LIST OF SYMBOLS

A	Contributing Drainage Area
A_c	Surface area of column
BD	Bulk density (g/cm^3)
C_c	Coefficient of Curvature
C_f	Target TSS concentration (mg/L)
C_{ini}	TSS concentration of raw stormwater runoff before dilution (mg/L)
C_u	Coefficient of Uniformity
C_v	Runoff Coefficient
D	Diameter of column
D_{10}	Grain size at 10% finer
D_{30}	Grain size at 30% finer
D_{50}	Grain size at 50% finer
D_{60}	Grain size at 60% finer
D_r	Relative density
G_s	Specific gravity
K_e	Total K_{sat}
K_{eff}	K_{sat} during the application of synthetic stormwater runoff
K_{ini}	K_{sat} during the application of clean water (tap water)
K_{rel}	Ration of K_{eff} over K_{ini}
K_{sat}	Saturated hydraulic conductivity (mm/hr)
L	Length of soil (m)
L_T	Total length of soil media
m	mass of soil material

n	a number of samples
P	Ponding depth (m)
P_D	Rainfall depth (mm)
Q	Outflow rates
R^2	Coefficient of Determination
V	Volume of soil materials
V_f	Working volume
V_{ini}	The volume required for dilution

LIST OF ABBREVIATIONS

AASHTO	American Association of State Highway and Transportation Officials
ANN	Artificial Neural Network
ANOVA	Analysis of Variance
APHA	American Public Health Association
ARI	Annual Recurrence Interval
BMPs	Best Management Practices
BOD_5	Five-day Biochemical Oxygen Demand (mg/L)
BOD_r	BOD removal
BSI	British Standard Institution
C	Compost
COD	Chemical Oxygen Demand (mg/L)
COD_r	COD removal
CS	Coarse Sand
Cu	Cuprum
CVF	Compost Fraction Volume
DID	Department of Irrigation and Drainage
DO	Dissolved Oxygen
DOE	Department of Environment
ESP	Exchangeable Sodium Percentage
ET	Evapotranspiration
FAWB	Facility of Advanced Water Biofiltration
FS	Fine sand
GLM	General Linear Model

HRT	Hydraulic retention time
IWS	Internal Water Storage
LID	Low Impact Development
MLR	Multiple Regression Method
MS	Medium sand
MSMA	Manual Saliran Mesra Alam Malaysia
N	Nitrogen
NH_3	Ammonia
NH_3-N	Ammoniacal nitrogen
NH_3-N_r	NH_3-N removal
NH_4^+	Ammonium
NO_2^-	Nitrate
NO_3^-	Nitrite
NO_x	Nitrogen gas
P	Phosphorus
Pb	Plumbum
PSD	Particle Size Distribution
REDAC	River Engineering and Urban Drainage Research Centre
PTF	Pedotransfer
RMSE	Root Mean Square Error
SAR	Sodium Absorption Ratio (SAR)
SCMs	Stormwater Control Measures
SD	Standard Deviation
SLR	Single Linear Regression
SUDs	Sustainable Urban Drainage system

TCOD	Total Chemical Oxygen Demand
TN	Total Nitrogen
TN_r	TN removal
TP	Total Phosphorus
TP_r	TP removal
TS	Topsoil
TSS	Total Suspended Solids
TSS_r	TSS removal
USCS	Unified Soil Classification System
USEPA	United States Environmental Protection Agency
WQI	Water Quality Index
WQv	Water Quality Volume (m^3)
WSUD	Water Sensitive Urban Drainage
Zn	Zinc

KAJIAN KEBERALIRAN HIDRAULIK MEDIA TANAH KEJURUTERAAN BAGI OLAHAN AIR LARIAN AIR RIBUT DI DALAM KEMUDAHAN BIOPENYIMPANAN

ABSTRAK

Kaedah konvensional sistem perparitan seolah-olah tidak mencukupi untuk memenuhi air larian permukaan bandar akibat peningkatan populasi bandar yang mendadak. Ia adalah terhad kepada pendekatan struktur yang berkaitan dengan pengaruh hidraulik dan hidrologi. Oleh itu, pendekatan ini telah beralih kepada pendekatan yang lebih holistik dengan mengambil kira keperluan alam sekitar. Pindaan garis panduan Manual Saliran Mesra Alam Malaysia (MSMA) pada tahun 2012 telah diperkenalkan pada bersesuaian dengan amalan semasa untuk menangani isu-isu air ribut bandar dan sub-bandar. Biopenyimpanan adalah amalan yang digalakkan yang menerapkan proses semula jadi, mengintegrasikan pengetahuan sains dan kejuruteraan hidrologi, hidraulik dan alam sekitar ke dalam satu sistem. Kajian ini bertujuan untuk menyelidik interaksi antara parameter hidraulik tanah terutamanya keberaliran hidraulik tepu (K_{sat}) dan prestasi olahan kualiti air dan penentuan K_{sat} sebagai penanda aras berdasarkan prestasi biopenyimpanan. Set data komprehensif yang diperlukan untuk kajian ini telah diperolehi daripada beberapa siri ujian makmal standard, kajian kolum yang direkabentuk dan penyiasatan lapangan. Bagi tujuan ini, tiga (3) kolum tanah telah dibina di Makmal Permodelan Fizikal, Pusat Penyelidikan Kejuruteraan Sungai dan Saliran Bandar (REDAC), USM. Empat (4) konfigurasi tanah dan satu (1) parameter hidrologi telah diuji untuk kajian ruang tanah: campuran tanah kejuruteraan, kedalaman media, bahan-bahan kompos, lapisan sungkupan dan variasi aliran masuk.